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(57) Abstract			
<p>The invention relates to a spreadable, predominantly water continuous acidified cream comprising more than 35 wt.% fat and less than 3 wt.% protein. Creams according to the invention have a butter like texture and a butter like melting behaviour. The cream is characterized by a free fat content at 65 °C of 30-85 wt.% on total fat and a Stevens value of 200-1000 g at 5 °C and 50-300 g at 20 °C. The cream has a fresh taste and a smooth creamy mouthfeel.</p>			

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ACIDIFIED BUTTER LIKE SPREAD

Field of the invention

5 The present invention relates to a spreadable, predominantly water continuous acidified cream comprising more than 35% fat. In particular the invention provides spreadable creams having a fresh taste, a smooth, creamy mouthfeel and a butter like texture and melting behaviour.

10

Background of the invention

There is a continuous desire among consumers for spreadable products that resemble traditional butter in mouthfeel and
15 texture, but on the other hand are spreadable at refrigeration temperature, and have a fresh taste.

Besides being not spreadable at refrigeration temperature, butter has a very high fat content. Furthermore butter has
20 a bland taste that may be considered very fatty and heavy in the mouth by modern consumers. There is a clear desire for more fresh tasting products, which are spreadable at refrigeration temperature, but will have a smooth, creamy mouthfeel and a fresh taste. Fresh taste is herein defined
25 as instant delivery of water soluble taste and flavour components, upon consumption.

A further desire is that these products show little or no syneresis, which is water loss upon increase of the
30 temperature of the product to room temperature.

US-4,177,293 discloses a butter spread comprising 19-48 wt% fat and a relatively high protein content of about 4.6-7.7 wt%. By repeated homogenization of a mixture of cream and vegetable oil, enriched with dried milk or protein concentrate, and by addition of a stabilizer a consistency similar to butter and good spreading characteristics are achieved.

US-4,769,255 describes a method for preparing a butter like composition which is spreadable at refrigeration temperature. The butter like composition comprises both a water-in-oil emulsion and an oil-in-water emulsion in a weight ratio of at least 6 to 4. Said products are predominantly oil continuous and therefore are believed not to give a fresh taste impression upon consumption.

US-4,772,483 discloses a product and process for preparing an all-dairy butter substitute. Cream with a butterfat content of about 40% is homogenized and heated to about 125 °F (51 °C). To the heated mixture are added salt, mono- and diglycerides, non-fat dry milk, locust bean gum, lecithin, potassium sorbate and citric acid. The resulting mixture is pasteurized, homogenized and packed. The protein content of the product is for example 2.3 wt%. It has been found that products disclosed herein, are non acidified soft products, that are very stable oil in water emulsions, that do not exhibit butterlike melting behaviour.

US-3,962,464 discloses a process for preparing a butter-like dairy product which process comprises a specific acidification step. It has been found that products

prepared according to this process are soft, pourable products.

DE-A-3,324,821 discloses a spread, based on soured cream. A
5 cream comprising skim milk powder, starch and gelatin is
heated to 110 °C, cooled and fermented to pH 4.0-4.5.
Optionally other ingredients are added. The mixture is
cooled to about 4 °C and left for crystallization in a
fermentation tank. The resulting product is homogenized and
10 packed.

None of these documents disclose a product that is derived
from an acidified cream and that has a butter like texture,
is spreadable, has a Stevens value at 5 °C of 200-1000 g,
15 preferably 300-800 g, most preferred 400-800 g and results
in a smooth, creamy mouthfeel but at the same time gives a
fresh not sour taste impression upon consumption.

Many known products have a high protein content. However
20 these proteins upon acidification and coagulation will form
a dense, cheese like texture very unlike the preferred
butter like texture of the current invention. In these
products allegedly the high protein content is necessary to
obtain a product of desired firmness.

25

A further disadvantage of the known products is that the
high protein content will prevent the formation of a butter
like texture. Furthermore said products are believed to
taste sour and to have a stable structure, resulting in a
30 "thick" mouthfeel.

The current invention is aimed at acidified creams having a butter like texture and a butter like melting behaviour. It is believed that the melting behaviour of known cheese like products will be markedly different from the melting
5 behaviour of butter. A suitable description of butter like texture and butter like melting behaviour of products according to the invention is given below.

Other known products comprising cream have a low protein
10 content of about less than 3 wt%, but these products do not show the required firmness and furthermore said products are believed to be very stable, such that they do not show butterlike melting behaviour. Such products are spoonable or pourable at refrigeration temperature.

15

The present invention aims at spreadable, water-continuous acidified creams which are very suitable as butter-replacement for cold uses, such as spreading on bread or toast, for example as an underlayer.

20

Summary of the invention

The present invention concerns a spreadable, predominantly water continuous, acidified cream comprising more than 35
25 wt% fat, up to 3 wt% protein, the cream having a pH value of below 5.8, a Stevens hardness value at 5 °C of 200-1000 g, and a Stevens hardness value at 20 °C of 50-300 g, a free fat content (as defined herein) at 65 °C of 30-85 wt/wt% on total fat, and said cream having a butter like
30 melting behaviour.

The invention furthermore concerns a process suitable to prepare such a product.

Detailed description of the invention

5

For the purpose of the invention, dry matter is defined as "all non volatile components of a product". This includes fat, protein, carbohydrates, minerals.

In this description and claims the expression "spreadable
10 cream" is intended to mean a plastic, spreadable cream which can be applied onto bread both at refrigerator temperature and at room temperature without tearing the bread. The spreadable creams of the present invention have a Stevens value at 5 °C of 200-1000 g and a Stevens value
15 at room temperature (about 20 °C) of 50-300 g. The product according to the invention shows low resistance to spreading, unlike traditional butter.

For the purpose of the invention "cream" is defined as a
20 dairy or vegetable fat containing, predominantly water continuous emulsion. The term cream is furthermore used in combination with the prefix "dairy" to indicate starting material comprising emulsified dairy fat.

25 Spreadable products comprising cream have for example been described in EP-A-347009 or EP-A-63389.

These documents disclose compositions comprising cream or acidified cream as the dispersed aqueous phase, present in a continuous fatty phase. It is believed that crystallized
30 fat constitutes the basis for the firmness of these products. These products are not water continuous and will

hence not show the fresh taste impression that is part of the mouthfeel of the product according to the invention.

Applicants believe that the butter like texture of
5 predominantly water-continuous products of the invention is caused by the presence of two types of fat structures; the so called intact fat globules and the so called free fat. Free fat is generally present in the form of less stable fat globules.

10 The free fat structure in the product of the invention is characterized by loose bridged aggregates of these fat globules. The bridging or coalescence is thought to occur between these fat globules of free fat.

15 Intact fat globules are individual fat structures, fully stabilized by the presence of proteins. The intact fat globules are substantially neither bridged nor aggregated.

Upon heating applicants believe that the free fat structure
20 will melt, collapse and separate from the emulsion, resulting in reduced in-mouth viscosity and providing a taste sensation of the fat soluble flavours, while the melting of the intact fat globules ensures a long lasting creamy mouthfeel.

25

The presence of these 2 types of structures of fat is believed to enable the spreadable consistency, combined with the desired in-mouth melting properties of products according to the invention. The presence of both intact
30 (non-bridged nor aggregated) fat globules and free fat in the form of bridged fat globules is believed to represent a butter like texture in the sense that two fat structures

with different melting behaviour can be identified both in butter and in the product according to the current invention.

Products according to the invention have excellent
5 mouthfeel upon consumption. The product melts in the mouth and the structure breaks up due to the high temperature. A first impression of the fat soluble flavours is followed by a creamy, fresh taste impression.

Nonetheless products according to the invention can be
10 clearly distinguished from butter and margarine-like products both due to the substantially fat continuous character of the latter and due to the lower percentage of non-bridged fat structure in products according to the invention.

15

The method to measure the amount of free fat present in the product at 65 °C is further illustrated in the examples.

The amount of free fat present in products according to the
20 invention at 65 °C is 30-85 wt%, preferably 40-80 wt%, more preferably 50-75 wt% of the total amount of fat present. The remainder of the fat is present as intact fat globules.

Applicants believe that the butter like melting behaviour
25 of products according to the invention can be expressed as a change in viscosity values at a shear rate of 10 s^{-1} within a defined temperature traject.

The method to determine said viscosity is illustrated in
30 the examples. All viscosity data which are indicated in this application have been determined by this method and under the conditions as disclosed for this method.

According to this method to measure said viscosity the composition at question is heated from 20 to 38 °C in a period of 32 seconds. During the heating the viscosity is 5 measured at a shear rate of 10 s⁻¹. After said 32 seconds said compositions are subjected to a very slow increase of temperature to 40 °C over a period of 270 seconds under a shear rate of 10 s⁻¹ (see examples).

10 It has been found that for compositions according to the invention having a butter like melting behaviour, preferably at least one of the following characteristics occurs when said compositions are subjected to the above method of heating under shear:

15

(a) after 32 seconds wherein the products are heated from 20 to 38 °C a viscosity of less than 10 Pa.s, preferably 0.05-10 Pa.s, more preferred 0.5-10, even more preferred 3-10 Pa.s, most preferred 5-8 Pa.s at a shear rate of 10 s⁻¹.

20

(b) after heating for 32 seconds from 20-38 °C, followed by a slow increase of temperature to 40 °C over a period of 270 seconds, a viscosity between 0.05 and 2.5 Pa.s, more preferred between 0.05 and 2 Pa.s, even more preferred 25 between 0.05 and 1.6 Pa.s, most preferred between 0.1 and 1.4 Pa.s at a shear rate of 10 s⁻¹;

(c) the products according to the invention show in one interval of 4 seconds during the 32 second measurement 30 period as indicated above, an average decrease in viscosity of 2-15 Pa.s per second at a shear rate of 10 s⁻¹.

Preferably the products according to the invention show two of the above characteristics (a-c), most preferred all characteristics (a-c).

5

It is believed that the substantial water-continuity of products according to the invention plays a large role in the freshness and light impression of said product. In combination with this fresh mouthfeel, the product gives a
10 non-sticky creamy mouthfeel but leaves no fatty impression.

The water continuity of the product can be demonstrated by determination of the conductivity of the spread. This method is illustrated in the examples.

15 Predominantly water continuous implies that the conductivity of products according to the invention is 0.1-50 mScm⁻¹, preferably 0.1-10 mScm⁻¹, at 10 °C.

The presently claimed cream derives its taste partly from
20 having been acidified, i.e. at least part of the dairy ingredients having been subjected to the influence of either an edible acidifying agent or to the influence of acidulating micro-organisms like lactic acid bacteria and cheese starter cultures or to the action of an acid
25 generating compound such as gluconodeltalactone.

Accordingly products according to the invention have a pH value of less than 5.8, preferably less than 5.6, more preferably between 4.0 and 5.6, even more preferably
30 between 4.6 and 5.2, and most preferred between 4.7 and 5.0.

Creams according to the invention comprise more than 35 wt% fat, preferably 40-80 wt% fat, more preferably 40-70 wt% fat, most preferred 45-60 wt% fat.

5 Said fat can be of dairy origin, but it is also possible to exchange part or all of the dairy fat with vegetable fat. Preferably at least 20 wt% butter fat is present on the total amount of fat. More preferably the amount of butterfat to vegetable fat is in the weight range of 20/80
10 to 80/20. Most preferred the weight ratio of butterfat to vegetable fat is between 40/60 and 60/40.

The dairy fat present in products according to the invention can suitably be obtained from the dairy source
15 used, such as dairy cream, butter, butterfat or fractions thereof, whole milk, protein enriched milk, concentrated milk, filled milk, fresh cheese, cream cheese or mixtures of two or more thereof, the use of dairy cream as at least one fat source being preferred.

20

The vegetable fat can be derived from any vegetable fat source. The vegetable fat is preferably selected from the group consisting of palm oil, palm kernel oil, soy bean oil, sunflower oil, rape seed oil, coconut oil, rice bran
25 oil, and combinations thereof; either as such or fractionated, hardened or interesterified.

The solid fat content of the fat blend of products according to the invention is preferably indicative of fast
30 in-mouth melting. Preferred blends melt more steep than butter. Preferably for the fat blend of the product according to the invention, N_{10} is between 40 and 80, N_{25} is

between 5 and 15 and N_{35} is between 0 and 5. Preferably the difference between N_{10} and N_{25} , for products according to the invention is between 35 and 65. The solid fat content on total weight of the fat blend can be measured according to the known pulse NMR method (ref. Fette, Seifen, Anstrichmittel 1978, 80, nr. 5, pp. 180-186).

Products according to the invention contain less than 3 wt% of protein. It was found that if more protein is present, a thick, cheese-like product is obtained. Preferably, the protein level ranges between 0.1 and 3 wt%, more preferably between 0.8 and 2.3 wt%, most preferred between 0.8 and 1.8 wt%.

15 The protein present preferably is milk protein and can suitably be derived from the dairy source used such as dairy, skim milk, butter milk, concentrated milk protein, butter serum, whey protein, whole milk, fresh cheese, another suitable milk protein source or mixtures thereof.

20

Besides proteins present in the dairy cream which is used as starter material, additional protein may be added to the product according to the invention. A preferred source of additional protein is butter serum. It is believed that the presence of phospholipids in butter serum contributes to a better, thinner mouthfeel and destabilization of the emulsion upon melting in the mouth.

Preferably 0.01-1 wt%, more preferred 0.05-0.3 wt% of protein derived from butter serum is present in products according to the invention.

30

Optionally phospholipids, preferably lecithin, may be present in the product according to the invention in an amount of 0.05-0.5 wt%, preferably 0.1-0.4 wt%, most preferred 0.1-0.3 wt%.

5

Said phospholipids can be derived from for example a dairy source such as dairy cream, butter or from a vegetable source.

10 Preferably products according to the invention comprise 0.1-10 wt%, more preferred 0.5-6 wt% most preferred 0.1-3 wt% of phospholipids on the total amount of proteins present.

15 For obtaining the desired structure and mouthfeel, it is preferred that the ratio of the fat content to protein content in the product is within the range of from 70:1 (weight ratio) to 12:1 (weight ratio), preferably 60:1 to 25:1, most preferred 40:1 to 30:1, in combination with a
20 fat content of more than 35 wt% and a protein content of less than 3 wt%, preferably less than 2.3 wt%.
Products comprising a lower fat to protein weight ratio are believed to show a more dense structure, dominated by protein coagulation. This is not intended for the product
25 according to the invention.

Products according to the invention are characterized by a Stevens value hardness at 5 °C of 200-1000 g, preferably 300-800 g, most preferred 400-800 g and a Stevens value
30 hardness at 20 °C of 50-300 g, preferably 75-200 g. This Stevens value hardness at 5 °C is believed to be higher than generally would be expected for products based on

acidified cream, comprising less than 3 wt% protein and more than 35 wt% fat.

Preferably the dry matter content of the product according to the invention is between 30 and 70 wt%, more preferably 40-70 wt%, most preferred between 50 and 65 wt% on total product.

For obtaining even better texture and mouthfeel 0.1-1 wt%, preferably 0.1-0.7 wt% of a protective hydrocolloid or another structuring agent selected from the group of agar, alginate, starch, gelatin, xanthan, locust bean gum, gelatin or gelatin replacers, carboxy methyl cellulose, guar gum or mixtures thereof, may be present in products according to the invention. Other suitable agents not mentioned here can be applied as well. More preferred, said protective hydrocolloid is gelatin or a gelatin replacer. Addition of a small amount of a protective hydrocolloid to the product of the current invention results in a surprisingly high improvement in the butter like texture and reduced syneresis. It is believed that said protective hydrocolloid immobilizes the water phase around the intact fat globules to reduce bridging between said intact fat globules. This way a product with an increased creamy mouthfeel results as an increased amount of intact fat globules is believed to be present in products comprising a small amount of protective hydrocolloid.

Optionally, up to 0.3 wt%, and preferably up to 0.2 wt%, based on the total weight of the end product, of an emulsifier is present. The emulsifier can be selected from the group consisting of monoglycerides, diglycerides,

lactylates, polyglycerol esters, diacetyl tartaric esters and mixtures thereof.

Optionally, additives such as salt, herbs, spices,
5 flavours, colouring matter, preservatives and the like may be added, although it is believed that if the butter like spread according to the invention is used as an underlayer, none of these is required. Normally, for use as a butter like spread at least some salt will be added. The preferred
10 amount of salt is 0.01-2%.

A preferred embodiment of the current invention relates to a spreadable water continuous acidified cream comprising

- (a) 40-70 wt% fat of which fat at least a part is of dairy
15 origin,
- (b) 0.01-1 wt% butter serum protein
- (c) pH 4.5-5.0
- (d) a total protein content of less than 2.3 wt%
- (e) a Stevens value hardness at 5 °C of 400-800 g
- 20 (f) a free fat content (as defined herein) of 50-75 wt% on total fat
- (g) said cream having a butter like melting behaviour as evidenced by a viscosity after 32 seconds (as defined herein) of less than 10 Pa.s at a shear rate of
25 10 s^{-1} .

The invention furthermore relates to a process to manufacture the proposed cream.

Products according to the invention can be prepared by any suitable process for the preparation of creams. A process
30 to produce products according to the invention can for example comprise the steps of preparing a mixture of an aqueous phase and a fat phase, pasteurizing and

homogenizing said mixture and fermenting with a lactic acid culture. Before packing the resulting fermented product may be cooled or heated to stop fermentation. According to an alternative embodiment fat is blended in an acidified aqueous phase, followed by homogenisation and optional heat treatment and/or cooling steps.

A preferred process for the preparation of products according to the invention comprises the following steps:

- 10 a) an emulsion of fat in aqueous phase is prepared at 10-60 °C,
- b) the emulsion is optionally homogenized at 40-60 °C,
- c) the emulsion is cooled to the acidification temperature of 20-50 °C,
- 15 d) the emulsion is acidified to a pH of less than 5.8, preferably less than 5.6, more preferably between 4.0 and 5.6, more preferably between 4.6 and 5.2, and most preferred between 4.7 and 5.0,
- e) optionally other ingredients such as gelatin,
- 20 thickeners, stabilizers, flavour, colouring agents, preservatives, salt are added,
- f) the emulsion is subjected to a heat treatment at 60-90 °C for 5 seconds-15 minutes, preferably under low shear;
- 25 g) the emulsion is optionally homogenized at 60-90 °C;
- h) the emulsion is optionally cooled to 5-60 °C
- i) the product is filled in the package and cooled to 5-15 °C
- j) the packed product is left to stabilize for 1-10 days
- 30 at 5-15 °C.

The process according to the invention can be carried out as a batch process or as a continuous process. All process steps may be carried out accordingly as batch process steps or continuous process steps or as a combination thereof.

- 5 For example the optional heat treatment according to step (f) may be carried out batch wise in a vessel or as in line heating.

Although it is possible to leave out the homogenisation
10 before acidification, to achieve the desired texture, it is highly preferred that the homogenisation of the product is carried out in two separate homogenisation steps before, respectively after acidification to obtain the desired product structure.

15

The homogenisation before acidification (step b) is preferably carried out at a temperature of 40-60 °C, at 20-300 bar, preferably 50-300 bar, more preferred 20-100 bar. Optionally said first homogenisation is carried out as a
20 two stage homogenisation whereby in a second stage the homogenisation pressure is lower than in the first stage. Pressures in the second stage are preferably below 100 bar, more preferred below 50 bar.

- 25 The homogenisation after acidification (step g) is preferably carried out at the same or a lower homogenisation pressure, than the first homogenisation (step b). Said second homogenisation is preferably carried out as a single stage homogenisation.

30

In a preferred process according to the invention, two homogenisation steps are carried out; a first

homogenisation treatment (step b) at 150-200 bar preceding the acidification, and a second homogenisation treatment (step g) at 50-150 bar after the acidification.

5 According to another embodiment, a first homogenisation treatment is carried out at 20-100 bar and a second at 50-150 bar.

The acidification in step (d) can be performed chemically
10 or microbiologically or with an acid generating substance such as gluconodeltalactone. If the emulsion is microbiologically acidified, the acidifying culture can be for example a multispecies starter comprising one or more strains selected from the group of species of *Lactococcus*
15 *lactis*, subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *lactis* var. *diacetylactis*, *Leuconostoc mesenteroides* subsp. *cremoris*, yogurt starter cultures (mixture of *Streptococcus thermophilus* and *Lactobacillus delbreuckii* subsp. *bulgaricus*), or mixtures
20 thereof.

According to another embodiment multispecies thermophilic starters are applied comprising strains selected from the group of *Lactobacillus acidophilus*, *Lactobacillus*
helveticus, *Lactobacillus casei*, *Bifidobacteria* or any
25 combination of strains providing that the acidification goes as far as needed, i.e. preferably to a pH below 5.8. In a preferred embodiment of the invention a multispecies starter comprising *Lactobacillus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp.
30 *lactis* var. *diacetylactis* and *Leuconostoc mesenteroides* subsp. *cremoris* is used.

The fermentation is stopped in a suitable manner - such as by heating - at a pH value below 5.8, preferably below 5.6, more preferably between 4.0 and 5.6, even more preferably between 4.6 and 5.2, and most preferred between 4.7 and 5.0.

Preferably the acidification is carried out at a temperature of 18-50 °C.

10 If a heat treatment is used to stop fermentation, then preferably this heat treatment is carried out at a temperature of more than 58 °C, more preferred between 58 and 90 °C for 0.1-30 minutes, preferably 1-10 minutes, after step (d).

15 Another suitable way to carry out said heat treatment is using for example a tubular heat exchanger in a continuous process. Shorter heating times are then obtained.

Said heat treatment can be chosen such that either the
20 culture used for acidification is inactivated, or stays (partly) active to make further ripening in the package possible.

If after fermentation a compound such as potassium sorbate
25 is added, which may result in an increased pH, the pH after fermentation is preferably reduced accordingly for example to pH 4.5 to compensate for said increase in pH.

According to a preferred embodiment the acidification is
30 stopped at pH 4.3-4.6 and subsequently in step (e) 0.02-1 wt% potassium sorbate is added after which preferably a pH of between 4.7 and 5.0 is reached.

According to yet another embodiment, the acidification is continued until a pH of below 5.8 has been reached. Subsequently the pH can be further adjusted upwards or downwards. The pH can for example be corrected upward using 5 potassium citrate, dairy cream or non-acidified milk.

Optionally in step (e) other ingredients such as gelatin, thickeners, stabilizers, flavour, colouring agents, preservatives, salt are added. If desired, a further fatty 10 phase can be added at this stage.

After acidification, according to step (f) the emulsion is subjected to a heat treatment at 60-90 °C for 0.1 to 15 minutes, preferably 1-15 minutes, preferably under low 15 shear. Applicants believe that the use of a heat treatment between 60 and 90 °C is beneficial to give the product the desired firmness, indicated by a Stevens value at 5 °C of 200-1000 g.

20 After acidification and the subsequent heat treatment and optional homogenisation, the product is preferably hot filled at a temperature of 60-90 °C, preferably 75-85 °C into containers and then the containers are cooled to a temperature of 5-15 °C, preferably 5-10 °C.

25

According to an alternative embodiment as indicated in step (h) above, the product is cooled to a packing temperature of 5-60 °C, preferably 8-30 °C, most preferred 10-15 °C and thereafter filled at that temperature.

30

According to an alternative embodiment the product can be foamed by treating for example with nitrogen, CO₂ or mixtures thereof, before filling.

- 5 It is preferred that the filled containers remain undisturbed for some time after filling to allow the final texture of the product to develop. Preferably the containers are left undisturbed at 5-15 °C for 1-6 days.
- 10 It is believed that a typical, butter like texture with two different fat phases as indicated above in the specification, can develop favorably under undisturbed conditions after filling the product in the package.
- 15 It is also an object to provide a mildly neutral tasting product having a closed keepability of several weeks. In a preferred embodiment, the products of the invention have a closed keepability of 8 weeks or more, which means that no change of taste and structure occurs on storage for such a
- 20 period.

For obtaining an increased closed keepability the cream is filled into containers while preferably at a temperature in excess of 65°C which containers then are hermetically

25 sealed. By filling at a temperature in excess of 70°C, a still better keepability is obtainable. By this higher temperature, the shelf life of the product in the closed container can be 8 weeks or even more.

- 30 The product according to the current invention can be used as butter alternative in cold applications such as an underlayer on bread. Furthermore the product according to

the invention is also suitable for use in warm and hot applications such as baking applications, use as an ingredient of a sauce and use in shallow frying applications.

5

The invention also regards composite food products such as creams, spreads, yogurt spreads, sauces comprising at least 30 wt% of the acidified cream according to the invention.

10 The invention will be illustrated by the following non-limiting examples.

In this application the terms oil and fat are used interchangeably.

15

Examples

Description of techniques

Determination of Stevens value

20

The "Stevens" hardness (St), expressed in grams, is determined 1 week after manufacturing. The product is stored at 5°C and thereafter equilibrated for 24 hours at a temperature of 5 or 20 °C as indicated. The Stevens value
25 is measured using a 0.5 inchØ cylindrical penetration probe and a Stevens-LFRA Texture Analyzer (ex Stevens Advanced Weighing Systems, Dunmore, U.K.) or SMS texture analyzer XT2 (ex Stable microsystems, Surrey UK). The load range is 1000 g for LFRA and 25000 g for SMS TA-TX2 equipment. The
30 Stevens LFRA Texture analyzer is operated in the "normal"

mode and set at 10 mm penetration depth and 2 mm/s penetration rate.

Determination of free fat content at 65 °C

5

Free fat is the amount of fat liberated by subjecting the sample suspended in water to a heat treatment up to 65 °C up to 1 hour. The butyrometer which is used is the butyrometer for measuring the fat content in cheese (ex

10 Fischer, scale 0-40% fat, 3 g sample input).

Said butyrometer is closed at the small end and is filled with water at a temperature of about 65 °C to half the bulb.

15 The product which has been stored at 5 °C for at least 16 hours, is transferred in an amount of 2-3 grams into a butyrometer for measuring the fat content in cheese. The weight of the sample is recorded (W (g)).

The butyrometer is subsequently closed at the big end,

20 inverted and the small stopper is removed. After gentle vortexing (Retsch mix TM01, speed 30%) to disperse the sample the butyrometer is placed in a water bath at a

temperature of about 65 °C for 10 minutes. The butyrometer is then gently vortexed (Retsch mix TM01, speed 30%) and

25 water at a temperature of about 65 °C is added through a small opening up to the top of the bulb of the butyrometer.

The butyrometer is then placed in a Gerber™ centrifuge capable of keeping the temperature at 65 °C and centrifuged for 15 minutes at 500 g. Afterwards the butyrometer is

30 carefully filled up to the 35% mark with water at a temperature of about 65 °C. Said butyrometer is centrifuged

at 500 g for another 15 minutes. Finally the butyrometer is read. The top layer consists of separated free fat.

The amount of free fat is expressed as the weight percentage on total fat. The following formula is used:

$$\text{free fat (\%)} = (((R1-R2)*3/W)/\text{fat percentage of sample}) * 100$$

wherein:

- 10 R1 = top of separated clear fat layer (%)
- R2 = bottom of clear fat layer (%)
- W = amount of sample (g)
- 3 = apparatus constant for butyrometer (g)

15 Determination of Conductivity

Conductivity was measured via a common procedure with a conductometer (Philips type pw 9526 Digital conductometer) and a measuring cell consisting of two metal plates (cell constant being 0.13 cm^{-1}). The measuring cell was calibrated using a KCl solution with a known conductivity. The sample was measured by pressing the plates in the product and reading the conductometer.

25 Viscosity measurements

Determination of the Viscosity during melting (Fast Viscosity Direct Measurement method) is carried out as follows.

30

The viscosity of the sample is measured with a Physica Reometer type Reolab MC 100tm. The readings were taken,

stored and evaluated on a personal computer equipped with the OTTI software. The reometer is equipped with a cone plate configuration (diameter of the cone is 4 cm) and the plate is temperature adjustable. The gap between the cone and the plate is set to 0.5 mm.

A sufficient amount of sample is placed on the plate to fit between the cone and plate. After positioning the cone, the surplus is wiped away. After applying the sample 5 minutes of time is taken to equilibrate the sample at 20 °C being the temperature of the plate. The shear rate of the cone is set to 10 s⁻¹.

The measurement is started by starting the reometer and changing the temperature of the plate from 20 to 38 °C after 4 seconds in a period of 32 seconds. Subsequently the temperature of the product is slowly raised to 40 °C over a period of 270 seconds maintaining a shear rate of 10 s⁻¹. Readings of viscosity are taken at 4 second intervals during 0-360 seconds.

Applicants believe the results may be interpreted as follows:

Time vs. viscosity gives a value for the "change in mouthfeel" during melting.

The first part of the measured curve gives the rate of decrease of viscosity. This parameter is calculated by taking the average viscosity change per interval of 4 seconds in the first 32 seconds of the measurement.

The viscosity is read at 32 seconds to give a value for the viscosity of the "melted product". For products according to the invention the viscosity after 32 seconds wherein the temperature is raised from 20 to 38 °C under a shear rate of 10 s⁻¹ is preferably less than 10 Pa.s.

- The end of the curve (302 sec) gives the viscosity of the sample when it is completely melted and worked. For products according to the invention the viscosity after heating for 32 seconds from 20-38 °C at a shear rate of 10 s⁻¹, followed by a slow increase of temperature to 40 °C over a period of 270 seconds at a shear rate of 10 s⁻¹, between 0.05 and 2.5 Pa.s.

Example 1

- 10 Procedure to produce up to 100 kg of the specified product.
The product composition is shown in table I.

Butter serum powder (BAEF ex Corman) was added to 2 l melted vegetable fat (50 °C) and this mixture was
15 homogenized in a turrax (Janke&Kunkel type 145 type) at a speed of 6 for 2 minutes. The resulting mixture (and the remaining melted vegetable fat) was added to the dairy cream (at 50 °C) while mixing (Terlet 150l vessel, stirrer speed 80 rpm) to form a course pre-emulsion. The resulting
20 mixture was homogenized at 50 °C, 200 bar (Gaulin Lab100-5PA, flow: 200 l/h). Subsequently the resulting emulsion was cooled to 28 °C (Terlet 50 l vessel, slow intermediate mixing at 20 rpm). The emulsion was acidified with 0.025 wt% of a mixture of cultures comprising *Lactococcus*
25 *diacetylactis* A ex Wiesby and a Probat 505 starter mixture ex Wiesby comprising *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis* var. *diacetylactis*, *Leuconostoc mesenteroides* subsp. *cremoris*. The emulsion was acidified until a pH of
30 4.5 was reached. After acidification carboxymethyl cellulose (7H 4XF, ex Hercules), gelatin (bloom 250, ex PB

Gelatin, Ierseke), salt, sorbate, and carotene were added. The ingredients were blended for 1 minute at 1500 rpm (55 °C) in a Wolff cutter[™] ex Wolf apparatebau GmbH, and heated at 85 °C for 5 minutes (350 rpm). Subsequently the mixture was homogenized at 100 bar (Gaulin LAB60-10TBS, 60 l/h) at 85 °C. The product was then hot filled at 85 °C and the sealed packages were left undisturbed at 5 °C for 6 days.

Example 2

10 Product composition is shown in table I.

Procedure is the same as for example 1 except for the following modifications. The acidified mix was homogenized at 100 bar (Gaulin LAB60-10TBS, 60 l/h) at 85 °C. The outlet of the homogenizer was connected to a static mixer
15 (length: 2m, internal diameter: 19mm). The product was cooled to a temperature of 25-30 °C and packed. The sealed packages were left undisturbed at 5 °C for 6 days.

Example 3

20 Product composition is shown in table I.

Fresh cream cheese and dairy cream (50 °C) were mixed to form an emulsion (6 minutes in a turrax ex Janke&Kunkel, speed 6). Subsequently the resulting emulsion was cooled to 42 °C. The emulsion was acidified with 2.5 wt% of a pre-
25 culture of MSKR1. (preparation of pre-culture according to instructions by Wiesby). The emulsion was acidified until a pH of 4.5 was reached. After acidification carboxymethyl cellulose (7H 4XF, ex Hercules), gelatin (bloom 250, ex PB Gelatin, Ierseke), salt, sorbate, and carotene were added.
30 The ingredients were blended for 1 minute at speed 15 (55 °C) in a Stephan[™] (Stephan UMC 5 electronic) and heated at

85 °C for 5 minutes (speed 6). Subsequently the mixture was homogenized at 100 bar (Rannie minilab 830H, 10 l/h) at 85 °C. The product was then hot filled at 85 °C and the sealed packages were left undisturbed at 5 °C for 6 days.

Table I, product composition

Ingredients	Example 1 (wt%)	Example 2 (wt%)	Example 3 wt%
Butter	6.1	6.1	
vegetable fat (1)	22	22	
Dairy cream 40%	70	70	
Dairy cream 60%			89
Fresh cream cheese (2)			10
Butter serum powder	0.5	0.5	
carboxymethy l-cellulose	0.25	0.25	0.25
Gelatin	0.25	0.25	0.25
salt	0.2	0.2	0.3
potassium sorbate	0.07	0.07	0.12
β -carotene	6-7 ppm	6-7 ppm	

(1): Palm kernel oil ex Loders Croklaan IMCO DP 3115, N
5 line: 20 °C: 26, 30 °C: 2, 35 °C: 0.

(2): Fresh cream cheese is a base product, characterized by
a dry matter content of 52 wt%, protein content of 7 wt%,
pH 4.7-4.8, fat content 43 wt%.

10 Water was added to ad up to 100%.

The products that result are characterized in table II.
All measurements were carried after the product had been maintained at 5 °C for 5 days.

5 Table II: product characterization

	Example 1	Example 2	Example 3
fat content (wt%)	55	55	59
protein content (wt%)	1.6	1.6	2.5
pH	4.78	4.86	4.92
Stevens value 5 °C, (g)	746	759	276
dry matter (wt%)	61.44	61.21	67
conductivity (mScm ⁻¹ , 10 °C)	1.9	1.9	ND
free fat content (wt/wt%)	66	71	ND
Viscosity (Pa.s) after 32 seconds (as defined)	2.9	ND	ND
slope (Pa.s.s ⁻¹) 12-16 sec 16-20 sec	8 5		
Viscosity (Pa.s) after 302 seconds (as defined)	0.6	ND	ND

ND: Not determined

All products are spreadable from the refrigerator, show a butter like texture, have a fresh taste and a creamy, smooth mouthfeel.

All products showed little or no syneresis.

5

Example 4

The product composition is shown in table III.

- 10 Butter serum powder (BAEF ex Corman) was added to melted vegetable fat (50 °C) and this mixture was suspended with a turrax (Janke&Kunkel type 145 type) at a speed of 6 for 2 minutes. The resulting mixture (and the remaining melted vegetable fat) was added to the dairy cream (at 50 °C)
- 15 while mixing (Terlet 1501 vessel, stirrer speed 80 rpm) to form a course pre-emulsion. The resulting mixture was homogenized at 50 °C, 100 bar (Gaulin Lab100-5PA, flow: 200 l/h). Subsequently the resulting emulsion was cooled to 28 °C in a tubular heat exchanger. The emulsion was
- 20 acidified with 0.025 wt% of a mixture of cultures comprising *Lactococcus diacetylactis* A ex Wiesby and a Probat 505 starter mixture ex Wiesby comprising *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis* var. *diacetylactis*,
- 25 *Leuconostoc mesenteroides* subsp. *cremoris*. The emulsion was acidified until a pH of 4.5 was reached. After acidification carboxymethyl cellulose (7H 4XF, ex Hercules), gelatin (bloom 250, ex PB Gelatin, Ierseke), salt, sorbate, and carotene were added. The ingredients
- 30 were blended for 1 minute at 1500 rpm (55 °C) in a Wolff cuttertm ex Wolf apparatebau GmbH, and pasteurized by in line heating from 55 to 75 °C in a few seconds.

Subsequently the mixture was homogenized at 50 bar (Nivo Soavi, Parma Italy, 10l/h type PANDA SN 3354) at 75 °C. The product was then hot filled at 75 °C and the sealed packages were left undisturbed at 5 °C for 6 days.

5

Example 5

The product composition is shown in table III.

10 The process of example 4 was used, with the modification that after the last homogenisation step, the product was cooled in line to 25 °C before filling and packaging. Packages were left undisturbed at 5 °C for 6 days.

15 Example 6

The product composition is shown in table III.

The process of example 5 was used.

Table III, product composition examples 4-6

Ingredients	Example 4 (wt%)	Example 5 (wt%)	Example 6 (wt%)
vegetable fat(1)	22	22	
Dairy cream 40%	76.61	76.66	34.8
Fat (2)			33.8
Butter milk powder			2.7
Butter serum powder	0.5	0.5	0.43
carboxymethyl-cellulose	0.25	0.25	0.28
Gelatin	0.25	0.25	0.8
salt	0.25	0.2	0.2
potassium sorbate	0.07	0.07	0.06
β -carotene	6-7 ppm	0.07	0.06

Balance to 100% is made with water

5 (1): Palm kernel oil ex Loders Croklaan IMCO DP 3115, N line: 20 °C: 26, 30 °C: 2, 35 °C: 0.

(2) Fat blend consisting of coconut oil, fractionated palm olein and soy bean oil. $N_{10}=35$.

Table IV: product characterization examples 4-7

	Example 4	Example 5	Example 6
fat content (wt%)	52.65	52.65	48
protein content (wt%)	1.72	1.72	1.71
pH	4.84	4.74	4.75
Stevens value 5 °C, (g)	632	751	990
Conductivity (mScm ⁻¹ , 10 °C)	4.2	4.2	4.6
dry matter (wt%)	57.34	57.34	53.34
free fat content (wt/wt%)	66	62	68
Viscosity (Pa.s) after 32 seconds (as defined)	1.4	2.4	5.2
(Pa.s. slope ⁻¹)	12	7.1	4.8
Viscosity (Pa.s) after 302 seconds (as defined)	0.9	1.5	2.0

ND: Not determined

All products are spreadable from the refrigerator, show a butter like texture, have a fresh taste and a creamy, smooth mouthfeel.

5 Comparative example A

The viscosity characteristics of a typical churned butter were determined with the method as indicated above:

- average decrease in viscosity (slope) in an interval of 4
10 seconds, measured during the first 32 seconds: 8 to 20 Pa.s per second at a shear rate of 10 s^{-1} .
- a viscosity after 32 seconds at a shear rate of 10 s^{-1} of about 5 Pa.s
and a viscosity after another 270 seconds of about 0.01
15 Pa.s at a shear rate of 10 s^{-1} .
- Applicants believe that the low viscosity value of 0.01 Pa.s after 302 seconds, is indicating a thin mouthfeel. The slope of 8 to 20 Pa.s per second at a shear rate of 10 s^{-1} is believed to be indicative of a quick melting
20 behaviour.
- Conductivity of butter was 0.00 mScm^{-1} , which is indicative of a fat continuous product.

Comparative example B

25

90 parts dairy cream standardised to a fat content of 26% were pasteurised at 85°C for about 10 minutes, such that denaturation of the whey protein occurred, and mixed with a solution of 0.8 parts gelatin, 0.8% parts whey protein
30 concentrate 70% and 0.3% parts salt, dissolved in 8 parts skim milk.

After cooling down to a suitable temperature for culturing, a common acidulating culture was added, whereafter the fermentation was allowed to proceed until a pH value of about 4.8 was reached. The fermentation was stopped by heating to 80°C.

The product so obtained was homogenised at 100 bar, filled in ¼l containers, cooled down to below 10°C and stored at chill temperatures.

10 Said products showed an end viscosity of 3.5 Pa.s after 302 seconds. This is believed to be indicative of "thick" mouthfeel. Furthermore these products had a too high protein content which was noticeable in the mouthfeel upon consumption.

Claims

1. Spreadable, predominantly water continuous, acidified cream comprising more than 35 wt% fat, up to 3 % protein, the cream having a pH value of below 5.8, a Stevens hardness value at 5 °C of 200-1000 g, and a Stevens hardness value at 20 °C of 50-300 g, a free fat content (as defined herein) at 65 °C of 30-85 wt/wt% on total fat and said cream having a butter like melting behaviour.
2. Cream according to claim 1, characterized in that said cream shows one of the following characteristics (a,b,c):
 - (a) after heating for 32 seconds from 20-38 °C a viscosity (as defined herein) of less than 10 Pa.s, preferably 0.05-10 Pa.s, more preferred 3-10 Pa.s, most preferred 5-8 Pa.s at a shear rate of 10 s^{-1} ;
 - (b) after heating for 32 seconds from 20-38 °C, followed by a slow increase of temperature to 40 °C over a period of 270 seconds, a viscosity (as defined herein) between 0.05 and 2.5 Pa.s, more preferred between 0.05 and 2 Pa.s, even more preferred between 0.05 and 1.6 Pa.s, most preferred between 0.1 and 1.4 Pa.s at a shear rate of 10 s^{-1} ;
 - (c) in one interval of 4 seconds during the 32 second measurement period, wherein the product is heated from 20 to 38 °C, an average decrease in

viscosity (as defined herein) of 2-15 Pa.s per second at a shear rate of 10 s^{-1} .

3. Cream according to claim 2, characterized in that said cream shows two, preferably three of the characteristics (a-c).
4. Cream according to any of claims 1-3 characterized in that said protein is milk protein obtainable from a dairy source which source can be selected from the group comprising skim milk, butter milk, concentrated milk protein, whey protein, butter serum, whole milk, fresh cheese, another suitable milk protein source and combinations thereof.
5. Cream according to any of claims 1-4, characterised in that the total amount of protein present is between 0.1 and 3 wt%, more preferably between 0.8 and 2.3 wt%, most preferred between 0.8 and 1.8 wt%.
6. Cream according to any of claims 1-5, characterized in that 0.01-1 wt%, preferably 0.05-0.3 wt% protein, derived from butter serum is present.
7. Cream according to any of claims 1-6, characterised in that the percentage of free fat is 40-80 wt%, preferably 50-75 wt% on total fat.
8. Cream according to any of claims 1-7, characterized in that said cream comprises 40-80 wt% fat, preferably 40-70 wt% fat, most preferred 45-60 wt% fat.

9. Cream according to any of claims 1-8, characterized in that the weight ratio of fat content to protein content in the product is within the range of from 70:1 (weight ratio) to 12:1 (weight ratio), preferably 60:1 to 25:1, most preferred 40:1 to 30:1.
10. Cream according to any of claims 1-9, characterized in that the fat blend of said acidified cream shows an N_{10} between 40 and 80 and N_{25} between 5 and 15 and N_{35} between 0 and 5, in combination with the difference between N_{10} and N_{25} being between 35 and 65.
11. Process suitable for the preparation of a cream according to any of the preceding claims, characterised in that:
 - a) an emulsion of fat in aqueous phase is prepared at 10-60 °C,
 - b) the emulsion is optionally homogenized at 40-60 °C,
 - c) the emulsion is cooled to the acidification temperature of 20-50 °C,
 - d) the emulsion is acidified to a pH of less than 5.8,
 - e) optionally other ingredients such as gelatin, thickeners, stabilizers, flavour, colouring agents, preservatives, salt are added,
 - f) the emulsion is subjected to a heat treatment at 60-90 °C for 5 seconds-15 minutes, preferably under low shear;
 - g) the emulsion is optionally homogenized at 60-90 °C;
 - h) the emulsion is optionally cooled to 5-60 °C
 - i) the product is filled in the package and cooled to 5-15 °C;

- j) the packed product is left to stabilize for 1-10 days at 5-15 °C.
- 12. Process according to claim 11, characterised in that the homogenisation before acidification according to step b is carried out at 40-60 °C and 150-200 bar, and the homogenisation after acidification according to step g is carried out at 60-90 °C and 50-150 bar.
- 13. Process according to claim 11 or 12, characterized in that in step (i) the product is hot filled at a temperature of 60-90 °C.

International Application No

PCT/EP 99/01977

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A23C9/15 A23D7/015 A23C13/16 A23C15/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A23C A23D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	---	1.4.5
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/01977

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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